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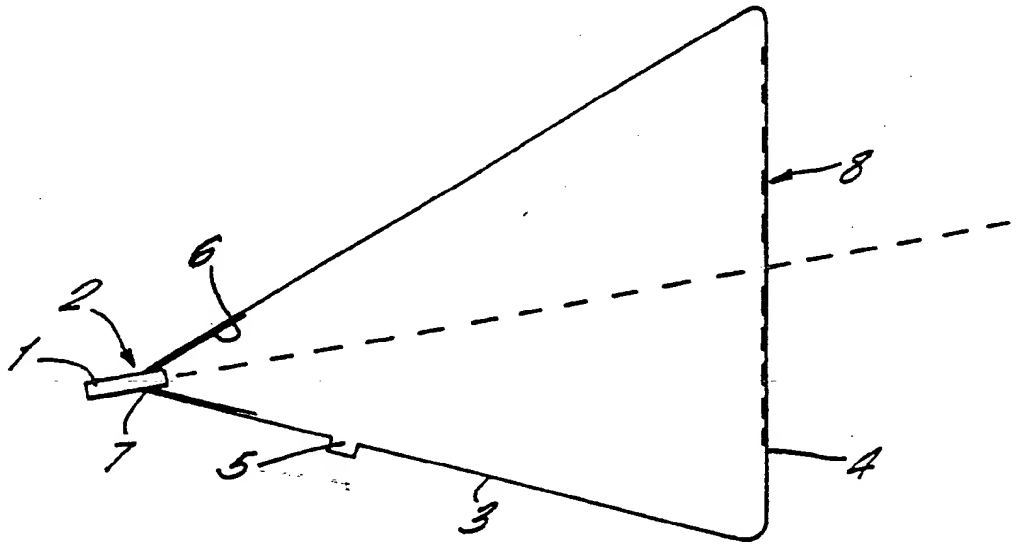

(57) Abstract

An antenna comprises a feed means (1), and an inflatable structure (3) having focusing means (8, 9) arranged such that the feed means (1) is at the focus of the focusing means (8, 9) when the structure (3) is inflated. The inflatable structure (3) can be of inelastic plastics material. The antenna has the advantages of cheapness and light weight, and of being easily transported either inflated or deflated.

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ANTENNAS

This invention relates to antennas, and in particular to microwave antennas.

Hitherto, microwave antennas have commonly comprised a rigid parabolic reflector with a mounting for a horn feed, the mounting frequently being a tripod arrangement extending from the reflector. In some antennas, the reflector is made of a number of component panels and the mounting is adapted to be collapsible so that the antenna may be more easily stored and transported.

A disadvantage of such antennas is that they are generally heavier than antennas which are not so adapted, due to the provision of hinges and fastenings. It will be appreciated that the hinges and fastenings need to be robust, and usually therefore heavy, in order to withstand repeated dismantling and still provide an antenna structure within the required design parameters.

According to this invention an antenna comprises a feed means and an inflatable structure having focusing means arranged so that the feed means is at the focus of the focusing means when the structure is inflated.

The antenna of this invention is not only considerably

lighter than known antennas both in use and when deflated, but is also compact when deflated, and thus very easily stored and readily transported.

Preferably, the focusing means is a Fresnel zone plate.

This is particularly advantageous since it obviates the need for a focusing means of, for example, a precise parabolic shape, which may not be readily achievable with an inflatable structure.

Conveniently the inflatable structure comprises a conical surface with a base, the feed means being positioned at the apex of the conical structure and the focusing means comprising the base of the structure.

The conical surface can be adapted to be substantially absorptive of the radiation employed by the antenna, thus minimising the spill over radiation and reducing the side lobe level compared to that associated with a conventional antenna of the same aperture.

The dark zones of the Fresnel zone plate can be adapted to be substantially absorptive of the radiation employed, thus minimising diffraction from the edges of the dark zone and leading to a reduced side lobe level.

Conveniently, the inside of the conical surface near to the apex can be coated with an electrically conductive film arranged to provide a predetermined feed illumination pattern.

The antenna of the invention satisfies a number of requirements which antennas comprised of rigid components have

been unable to meet. At the high frequencies which will be utilised by satellites such as the European Space Agency's Olympus, the overall dimensions of an antenna with useful gain are of the order of a few centimetres and thus suitable antennas in accordance with the invention can be carried as personal baggage. At the somewhat lower frequencies currently used by Direct Broadcasting satellites, the required antenna dimensions are of the order of 1 metre. Consequently, an antenna in accordance with the invention can satisfy the requirement for the receipt of signals from such satellites, and yet be readily carried by an individual, when either inflated or deflated.

Further, very large antennas in accordance with the invention can be manufactured, transported and installed at a fraction of the cost of conventional antennas requiring complex rigid backing structures.

An antenna in accordance with the present invention will now be described with reference to the drawings, in which:-

Figure 1 is a schematic cross-section through the antenna; and

Figure 2 is a plan view of a Fresnel zone plate used in the antenna of Figure 1.

Referring to the drawings, a microwave feed 1 is inserted through a gas tight seal 7 at the apex 2 of an inflatable conical structure 3. The conical structure 3 has a microwave transparent base 4 upon which a series of rings 9

forming a Fresnel zone plate 8 has been applied. An inflation valve 5 is provided in the conical structure 3 to allow for the inflation and deflation of the antenna. The conical structure 3 is made of a lightweight inelastic gas tight plastics material. An electrically conductive film 6 is provided on the inside of the conical surface near to the apex 2 and is configured to provide a predetermined feed illumination pattern, optimised to the dimensions of the zone plate 8.

For an antenna adapted for transmitting microwave signals, it is desirable to make the dark zones of the Fresnel zone plate 8 of microwave absorbing material. Further, the outside or the inside of the conical structure 3 can also be coated with a microwave absorbing material. In this way, the defraction from the edges of the dark zones and the spill over radiation are both reduced. Consequently, the side lobe level will be substantially lower than that of a conventional antenna of the same aperture. It will be appreciated that for two-way operation, the microwave feed 1 will be adapted to allow duplex operation by, for instance, frequency or polarisation discrimination.

Referring now specifically to Figure 2, this shows the Fresnel zone plate 8 with its rings 9. Each ring 9 can be made of a microwave reflecting material such as graphite, nickel or silver ink or alternatively a microwave absorbing material such as an absorbing paint. The rings 9 can be applied by silk scr en printing, spraying or any other method well known in th

art. The configuration of the rings 9 is also known in the art and will not be further described herein.

In use, the deflated antenna is simply connected via inflation valve 5 to an inflation means (not shown) and the antenna inflated such that the structure 3 is rigid and the feed means 1 positioned at the focus of the Fresnal zone plate 8. It may be necessary in some applications to provide internal strappings (not shown) to ensure that the inflatable structure 3 adopts the precise shape required.

It will be appreciated that the conical surface 3 need not be a right circular cone, but may be, as illustrated in Figure 1, arranged so that the base, when substantially vertical, focuses radiation from a non-horizontal source on to the feed 1. The precise shape of the inflatable structure 3 will depend upon the circumstances in which the antenna will be used, for instance, the elevation of the satellite from which signals are to be received.

CLAIMS

1. An antenna comprising a feed means and an inflatable structure having focusing means arranged so that the feed means is at the focus of the focusing means when the structure is inflated.

2. An antenna as claimed in Claim 1, wherein the focusing means is a Fresnel zone plate lens.

3. An antenna as claimed in Claim 1 or Claim 2, wherein the inflatable structure comprises a conical structure with a base, the feed means being positioned at the apex of the conical structure and the focusing means comprising the base of the structure.

4. An antenna as claimed in Claim 3, wherein the inside of the conical surface near to the apex is coated with an electrically conductive film arranged to provide a predetermined feed illumination pattern.

5. An antenna as claimed in Claim 3 or Claim 4, wherein the conical surface is adapted to be substantially absorptive of the radiation employed by the antenna.

6. An antenna as claimed in Claim 2, or Claim 3, Claim 4 or Claim 5 as dependent on Claim 2, wherein the dark zones of the Fresnel zone plate are adapted to be substantially absorptive of the radiation employed by the antenna.

7. An antenna as claimed in any preceding claim, wherein the inflatable structure is made of a lightweight inelastic plastics material.

8. An antenna substantially as hereinbefore described with reference to the drawing.

FIG. 1.

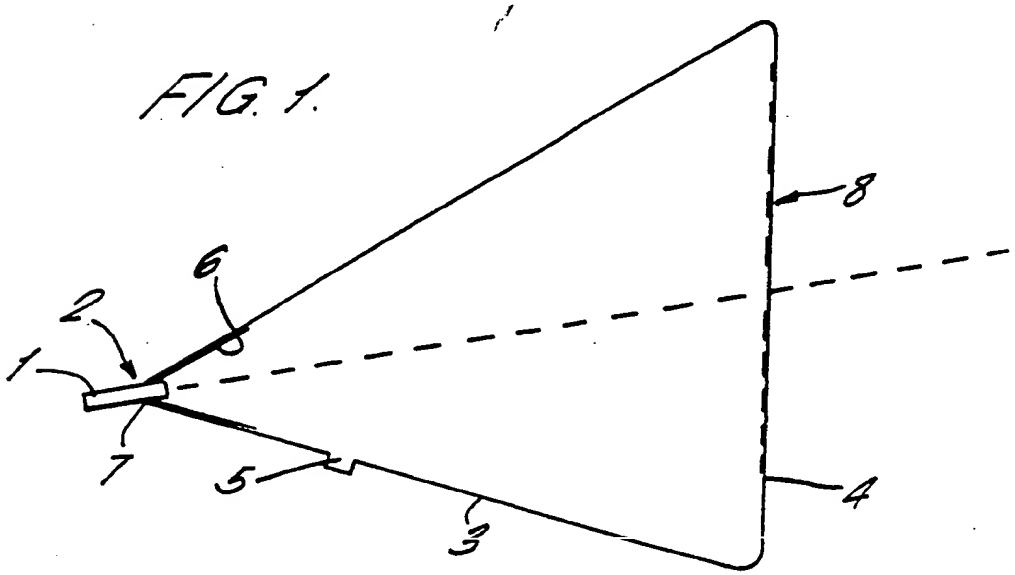
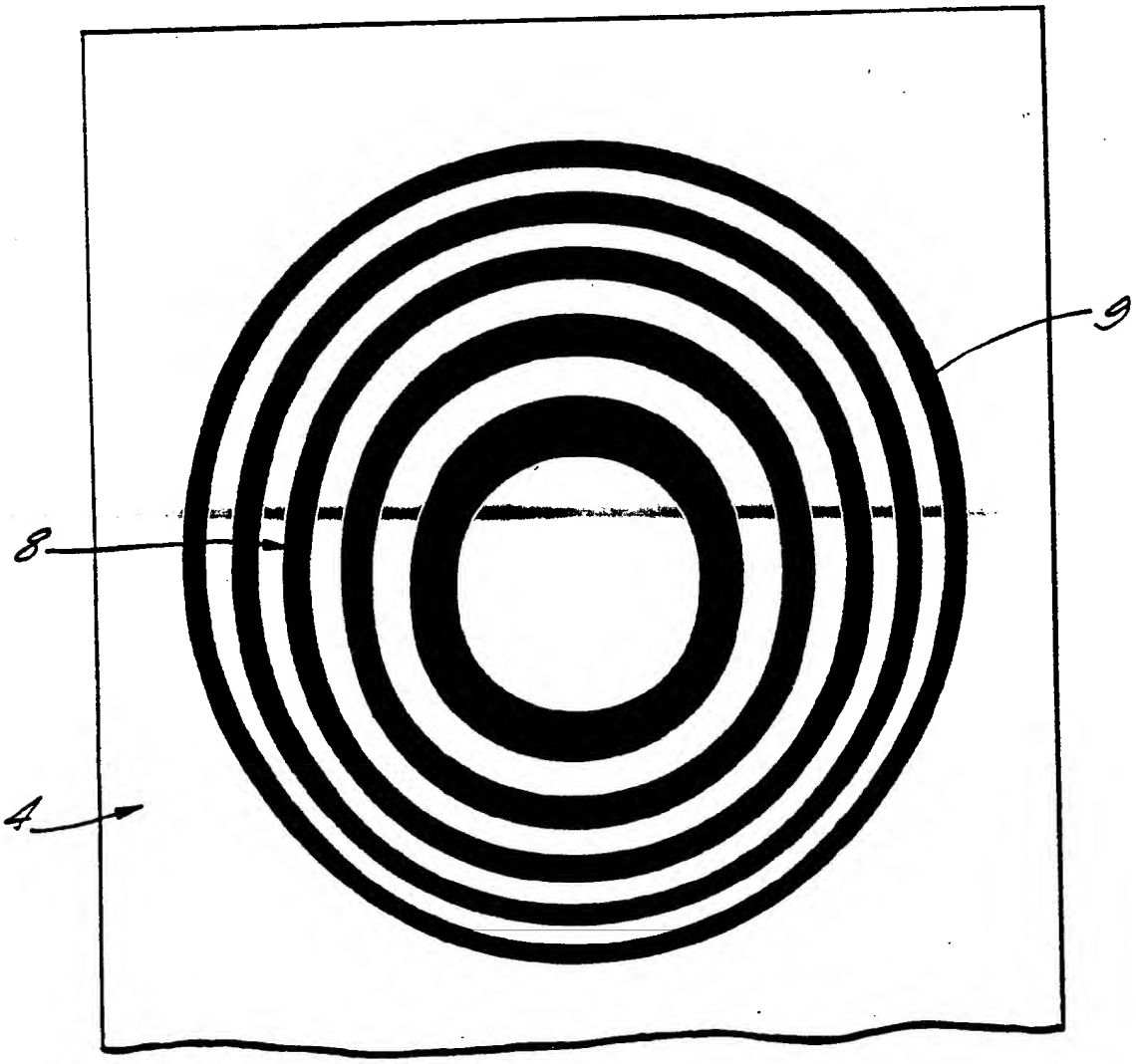


FIG. 2.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 89/00879

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: H 01 Q 1/08, H 01 Q 19/06, H 01 Q 15/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	H 01 Q

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	US, A, 3273155 (RAABE) 13 September 1966, see column 8, line 46 - column 9, line 33; figures 8,19	1,2,6-8
Y		3
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Y	IEEE Northeast Electronics Research and Engineering Meeting, NEREM Record 1966 IEEE (Boston, US) R.M. Dickinson et al.: "A survey of unfurlable spacecraft antennas", pages 222,223, see page 223, figures 4,6	3
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A	US, A, 3321763 (IKRATH et al.) 23 May 1967, see claims 1-5	3-5
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A	IEEE Transactions on Antennas and Propagation, vol. AP-32, no. 3, March 1984 IEEE (New York, US) W.L.H. Shuter et al.: " A metal plate fresnel lens for 4GHz satellite TV reception"	2,6,7

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th October 1989	28. 11. 89
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	pages 306,307 see the whole article	

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3273155		None	
US-A- 3321763		None	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82